AURAL VERTIGO (MENIÈRE'S DISEASE ?)[1]

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MR. PRESIDENT AND MEMBERS: My purpose in presenting this case to you to-night is to discuss briefly the nature of vertigo and the particular form of it known as Menière's Disease, and to show that the name Aural Vertigo is a misleading one, inasmuch as the aural symptoms are not necessarily indicative of trouble in the ear.

CASE.—Mrs. E. M., forty-five years of age, a German, originally of Berlin, now of this city, first came to me March 24, 1890, on account of excessive vertigo and deafness in the left ear. Inquiry elicited nothing of special import in connection with the patient's family history. Of a strong and healthful physique, she had never known any sickness save an attack of scarlet fever in childhood, and a carbuncle which was removed from the back of the neck in 1869. Her husband being a sea captain, she accompanied him on his voyages from 1869 to 1876. He has never had any illness except rheumatism, malaria and dyspepsia. Patient has never given birth to any children, but had two miscarriages while at sea. In 1876, while in New York, she was confined to her bed three months with a severe attack of acute rheumatism. Her physician then told her she also had "dropsy of the heart." At the end of the three months she returned to Philadelphia, and was immediately stricken down with another attack of rheumatism, which lasted two months. About the same time she began to be troubled with severe attacks of asthma. From that time on she enjoyed comparatively good health, being troubled only with slight rheumatic pains, palpitation of the heart and asthma. She had always been a hearty eater. One evening two weeks before she came to me, she ate heartily of oysters and drank freely of beer. She retired for the night and slept well for about two hours. Then she was suddenly awakened with a horrible nausea and distress in the stomach. With this there was an intolerable vertigo, but on account of her general wretched feeling at the time, the patient remembers nothing of the character of this vertigo. Violent vomiting of "a green, bilious matter" then came on, and seemed to repeat itself every fifteen minutes. During all this time the patient was never for a moment unconscious, though she screamed with the agony, frontal headache and violent dizziness. In the morning the vomiting still continued and when she attempted to get up she was so dizzy that her husband had to catch her to save her from falling to the floor. She seems to have had both the subjective and objective varieties of vertigo, for she says objects were swimming in all directions and she felt as though she herself were spinning round like a top. There was no defect in the eyesight, and only a slight frontal headache. It was now that she noticed, for the first time, loss of hearing in the left ear. She says she thought it was complete. There was also marked tinnitus, which she describes as one "pounding on metal," alternating with the peculiar noise made by a "group of birds in the grass." At this time the vertigo was like that which is felt in seasickness ; it was irregular and of the swaying and balancing variety. The vomiting continued for three days with more or less fever, flushings, sickness and general distress.

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Two weeks later, when I first saw her, the vertigo was still so great that a companion had to accompany her to keep her from falling. There was no more vomiting or fever. From the right ear my watch, a soft-ticking one, could be distinctly heard at a distance of nine inches. In the left ear the power of hearing was totally gone. The sound of the tuning-fork placed against the side and top of the head, as well as at the teeth, was always referred to the right ear. An otoscopic examination revealed nothing abnormal. There was no tinnitus at this time. The vertiginous sensation caused objects to rotate from left to right, and the subjective vertigo was not so marked as it seems to have been at first. Patient thought the eyesight of the left eye was impaired, but examination revealed no marked abnormality ; a sensation of twitching about this eye seems to have been rather subjective than real. Examination of the heart exposed the effects of a previous severe attack of endocarditis. The pulse was rapid, irregular and tumultuous. There was marked insufficiency of the mitral valve as shown by the loud systolic murmur. Dyspnœa, præcordial distress, cough and mental anxiety were also among the cardiac symptoms. Suspecting embolism of the auditory artery of the left side, I placed the patient on ten grains of the iodide of potash three times a day.

On March 26 the report was "great improvement." The vertigo had entirely disappeared and the patient felt stronger in every way. The loss of hearing, however, remained the same. A week or two later two grains of quinine, every two hours, were given for one week. This was an experimental trial of Charcot's recommendation of quinine in Menière's disease. April 24th patient saw no improvement in the hearing, but said she felt much worse and that the asthmatic attacks were more troublesome while she was taking the quinine. She then returned to the potassium iodide, which she has taken in doses sometimes of ten, sometimes of fifteen grains, alternately with periods of complete rest, and some sedative for the cough, up to about a month ago. About the middle of May she experienced considerable roaring and crackling in the affected ear, but no increase in the power of hearing. This diminished slightly and was at times replaced by a peculiar "sticking, itchy" sensation in the ear. In July the tinnitus was of a buzzing character, and now when there is loud talking in the room patient says she hears the confused noise as of "birds in the grass." During all this time, however, there has never once been any distinct return of the hearing. Aside from this one difficulty the patient is as well as she was before the night when the vomiting, vertigo and loss of hearing came on.

At my request, Dr. Charles S. Turnbull kindly examined the patient on November 8. The following opinion is copied from a letter which he wrote me on November 10:

"Mrs. M—— came to see me on Saturday. . . . I found total left-sided deafness, due, no doubt, to embolism of the internal auditory artery. The examination of the auditory apparatus proved negative in its results. The membrana tympani, tympanum and eustachian tube I found normal, as also the functions of the middle ear and its appendages; *i. e.*, the air in the tympanum was renewed with each act of deglutition and 'valsalva' showed air to enter the tympanal cavity and from inward move the membrana tympani outward.

"Loss of hearing was *absolute*, as tested by the tuning-fork, and no apparent symptom of auditory power remained save the tinnitus aurium.

"Tinnitus was of the high-pitched variety and indicated pressure. Doubtless the infarction was so complete as to induce total deafness; nevertheless there was enough of a leakage, or it might be anastomotic action, to permit of a certain amount of pressure action on this nerve (auditory) that we could notice its effect; similar in action to the cloud-like coruscations noticed by the blind in their sightless eyes.

"I am under the impression that the lung trouble induced the heart's action, or, better, malaction, and a clot was driven to this remote auditory region."

The general condition of the patient, the suddenness of the attack, the unilateral character of the affection, the limited nature of the symptoms, the gradual and permanent amelioration of the vertigo, the total loss of hearing and the absence of more positive bulbar and aural signs, long ago inclined me to this opinion, in which I have been confirmed by Dr. Turnbull.

Before the invention of the ophthalmoscope nearly all forms of blindness, whatever their cause, were known as amaurosis. Otology is much in the same position to-day that ophthalmology was then, and all forms of vertigo associated with auditory symptoms are spoken of as aural vertigo, though in many of the cases the ear trouble seems to be quite independent of, or at most only coincident with the vertiginous symptoms. The confusion is doubtless due to our ignorance of the exact nature of vertigo. The study of this phenomenon is one of the most intricate in medicine, and though we are quite familiar with its objective and subjective manifestations, its immediate cause is as much a mystery as ever. The maintenance of equilibrium has been assigned to a special centre, located nobody knows where. It has been thought that the cerebellum somehow controls, through its co-ordinating function, the equilibrium of the body. A disturbance of the customary harmonious action and interaction of all parts of the brain has been deemed the origin of vertigo. And, finally, equilibrium has been considered as purely a psychic act, dependent more upon the conjoined normal activity of the will, memory and reason than upon any physical lesion in the sensory or motor areas of the brain. There are plausible arguments for every one of these hypotheses, but the theory is yet to be advanced that will satisfactorily explain all forms of disturbed equilibrium, those purely reflex as well as those that seem to be without cause.

However we may regard the experiments of Flourens and Goltz as proofs of the function of the semicircular canals, clinical evidence compels us to admit that they alone do not subserve the maintenance of equilibrium. The multiplicity of impressions constantly pouring in upon the brain through the various avenues of sensation other than the ear must necessarily assist in keeping the mind under such a degree of tension that the slightest disturbance in one way or another will perforce result in mental confusion and more or less vertigo. As Foster has aptly put it, "All day long and every day, multitudinous afferent impulses, from eye and ear, and skin and muscle, and other tissues and organs, are streaming into our nervous system, and, did each afferent impulse produce its correlative motor impulse, our life would be a prolonged convulsion. As it is, by the checks and counter checks of cerebral and spinal activities, all these impulses are drilled and marshalled and kept in hand, in orderly array, till a movement is called for; and thus we are able to execute at will the more complex bodily manœuvres, knowing only *why* and unconscious, or but dimly conscious, *how* we carry them out." We know how any sudden mental excitement will cause a nervous person to become dizzy and nauseated; but to establish the condition of true vertigo, the disturbance must needs be more positive in its character, continuous in its action and uncontrollable either with moral or physical means.

Physiological psychologists are pretty well agreed now that our knowledge of the relation of things, as well as of space and its dimensions, is the result of the experience gained by the use of our muscles. The infant becomes gradually cognizant of these dimensions of space by the constant application of its hands to the objects which it sees. Even the sight, which is the only other sense that reveals to us an extended objective world, and that never shows us more than two dimensions of space at one and the same time, does so entirely through the muscular sense exercised in the use of the muscles of the eyeball. Experiment, as well as clinical observation, proves this. Now when we study the nature of equilibrium, we discover that it is dependent upon a normal consciousness of the proper relationship of things found outside of the centres of consciousness. It is not purely psychic, as some have thought– a mental disturbance caused by an abnormal action between the mental faculties. There is the sensation of a motor process in it. Dr. Hughlings Jackson has long urged the importance of this fact, and Dr. Reynolds pointed it out in 1854, when he wrote : " The feeling of equilibrium results from the harmony of our different sensations among themselves and with the motor impulse which is their combined effect. When any one group of the sensorial impressions is distorted or removed, the balance is disturbed, and as these impressions are themselves the stimuli of muscular action, attempts are made for its restoration . . . producing vertiginous or allied movements." The principal factors in the preservation of equilibrium are consciousness and normal sense impressions. In point of time the normal sense impressions should stand first, for if they are discordant the consciousness itself becomes more or less obscured, as in the condition popularly known as dizziness. Consciousness, on the other hand, must be more or less alert for the condition of vertigo to obtain, since obviously when consciousness is in total abeyance, vertigo cannot be experienced, however conflicting and discordant may be the inpouring sense impressions. In true vertigo there is no actual loss of consciousness, but at the acme of an attack the latter may be very greatly obscured. Hence we conclude that vertigo is a disturbance in the action of some centre or centres, and not a mere consciousness of some peripheral disorder ; and that the two immediate factors in its causation are, disturbance of those cerebral centres which go to make up consciousness, and of the peripheral sensori-motor apparatus manifested directly or indirectly through the so-called " muscular sense." A vertiginous impression reflected through the consciousness may end in a *complete* or *incomplete* motor act. In the latter case there is merely a residual disturbance of past impressions without a fulfilment of the present impulse in complete motion, while in the former, the patient is uncontrollably moved in one direction or another.

If the views of Spitzka and Starr in regard to the sensory paths in the medulla be correct, they bear strongly in favor of this sensori-motor theory of vertigo. Thus Spitzka concludes that impressions from the cochlea reach the cortical centres in the superior temporal gyrus by way of the posterior division of the eighth pair of nerves, the trapezium of the same side, part of the lemniscus, posterior pair of the corpora quadrigemina suternal geniculate body and the corona. According to some late observations of Starr, which prove the correctness of the views of Flechsig and Von Monakow, the lemniscus tract is associated with the so-called "muscular sense," and is chiefly distributed to the inferior quadrigeminal body. Some physiologists think that it is even continued up as far as the corona. It is believed that this tract is associated with the sense of sight as well as with the co-ordination of movements. Flourens found that injuries to the corpora quadrigemina of one side caused "forced movements," and that their complete removal reresulted in incoördination of movement; yet we have no knowledge of any connection between these bodies and the cerebellum, though it is barely possible such a connection does exist. At all events, the point which I wish to insist upon is the close relationship of all these tracts for sight, hearing, and the "muscular sense" in the corpora quadrigemina and the more distinct termination of all these tracts in the cerebral cortex than in the cerebellum.

If vertigo were a kind of encephalic ataxia, and due simply to disturbed co-ordination, it might be readily located in the cerebellum, and then the *probable* connection of this part of the brain with the organs of sight, hearing and muscular sensibility, would easily explain the vertiginous sensations in disease of any of these peripheral end-organs. While the function of the cerebellum may be that of co-ordination and the maintenance of "continuous tonic muscular contractions," and while, as Spitzka tersely remarks, it may be the centre where "impressions of touch and position are associated with those of time and space," I find no authority for assuming that it is in any way the centre for the institution of movements, or the maintenance of these movements in a regular, methodical manner, which to my mind is the underlying phenomenon of true vertigo. Vertigo is something more than simple incoördination, though incoördination may enter as one of its principal elements. In vertigo there is a disturbance not merely of the reflex functions, but of the higher powers as well. The motor and sensory phenomena of vertigo, in typical cases, at least, are not mere sequences of abnormal motor and sensory impulses, but they are the impulses themselves. The distinction which I am endeavoring to make is the same as that between the ataxic movements of posterior spinal sclerosis and the spontaneous movements of chorea. In the one case there is the retention of power, but the loss of co-ordination ; in the other there is loss of power with or without co-ordination. Simple incoördination manifests itself in irregular, unmethodical movements, and thus shows that it is due to an affection of some subordinate regulating centre of the brain ; true vertigo, like chorea, manifests itself in regular, methodical movements and thus reveals disease of a higher independent centre.

It is a significant fact, when considered in this connection, that the vertigo which is so characteristic of cerebellar disease, and which is identical with the vertigo of Menière's disease, is caused only by lesions in the middle lobe or that part of the cerebellum which is most liable to involve the sensory-motor tracts of the medulla ; and furthermore, that lesions of the lateral lobes not pressing upon or involving the middle lobe do not give rise to any known symptoms. And it is still more significant that vertigo is not pathognomonic of cerebellar disease, for it may be caused by lesions in other parts of the brain as well. Even in its co-ordinating function, it is more probable that the cerebellum, instead of sending out direct co-ordinating impulses to the muscles, merely co-ordinates the impulses sent down from the cerebral centres above. Indeed, as Ranney has said, "it is a curious fact that most of the effects of cerebellar lesions are attributable, to a greater or less extent, to irritation of the crura."

Every indication points to the fact, then, that we must look for the centre of equilibrium not in one particular part of the brain, but in the harmonious action of the various sensory and motor centres upon one another.

Now for the application of all this. One of the most common peripheral disturbances of this sensori-motor equilibrium is disease of the ear. Hecker has said that "the ear is the most intellectual of all the organs," and in regard to its effect upon the mind, both in health and disease, it is indeed second in importance only to the eye. Without stopping to consider the many causes of vertigo dependent upon affections of the external and middle ear, let me refer briefly to a few points in connection with labyrinthine vertigo. It is pretty generally considered now that only the semicircular canals are affected in *true* Menière's disease. At least that is what Menière himself seems to have believed. His second and fourth propositions are that certain functional troubles, having their seat in the *internal auditory apparatus*, may give rise to cerebral symptoms, such as intense vertigo, uncertainty of gait, turnings to the right or left and falling, all of which may be attended with nausea, vomiting and syncope ; and that all this tends to confirm the belief that the lesion which is the cause of these functional troubles is in the semicircular canals. In his original paper he described ten cases, in only one of which was there an autopsy. This case, the tenth of the series, had no disease of the nervous centres, but the semicircular canals were filled with a "reddish plastic material." It was on the strength of this single observation that he declared the canals to be the cause of the cerebral symptoms. Aside from the unscientific character of such a hasty generalization, this one case, as Bremner points out, will hardly explain those in which the cerebral symptoms come and disappear rapidly. And if the hæmorrhage into the semicircular canals were the cause of the trouble here and in the majority of the apoplectiform cases, as Knapp argues, it remains to be shown why the hæmorrhage should be bilateral, since the aural symptoms are so frequently bilateral.

Ever since the first announcement of this affection there has been much confusion in regard to it. Disease of any part of the internal ear, and even of the middle ear, has been called Menière's disease, though, as we have seen, Menière himself was careful to restrict the lesion, in its apoplectiform form at least, to the semicircular canals. Knapp, whose paper upon the subject is second only to that of Menière himself, includes all affections of the entire internal ear, irrespective of their causes, under the name of Menière's disease. I have examined his cases, and fail to see why he should insist so positively upon the inner ear as the cause of the vertigo and other cerebral symptoms. In his third case, which he is careful to specify as a fair example of Menière's disease, one of the most prominent symptoms was diminution of the sight—a condition which remained after many of the other symptoms had disappeared. After discussing in full Voltolini's famous case in which an autopsy revealed an extensive leptomeningitis with pus at the base of the brain in the pons, medulla and cerebellum, and some hæmorrhage into the labyrinth of the ear, he makes the sweeping generalization that "the changes in the nervous apparatus of the labyrinth consequent on the hæmorrhage must have been such as to destroy the hearing function forever." Thus he totally ignores the possibility, and in Voltolini's case the extreme probability, of the central injury being the cause of the deafness as well as of the vertigo and other symptoms. In Politzer's case, with autopsy, there was a fissure of traumatic origin at the base of the occipital bone, which probably was the cause of the meningitis of which the patient died. Pain at the base of the brain was here a marked symptom.

According to Knapp, loss of consciousness, constant tinnitus and cloudiness of the visual field are, strange to say, symptoms prominent amongst those of Menière's disease; and I am incapable of understanding his argument when he says that "deafness for certain groups of musical sounds is proof positive that the disease is neither limited to the acoustic nerve outside the labyrinth, nor to the semicircular canals and vestibule, but that it extends to the cochlea." It seems to me pressure of an encephalic tumor, for example, upon a part of the nerve, might readily account for a loss of hearing to certain tones of the key-board.

In most of the reported cases of Menière's disease that I have seen, while there was a possibility of the ear trouble being the origin of the special symptom-group, there was an equal possibility, and in very many of the cases a strong probability, that the more prominent symptoms were due to a central or medullary lesion, and that the aural symptoms were merely a coincident member of the group.

Gowers, who is one of the strongest advocates of the labyrinthine origin of vertigo, adduces five arguments in favor of his position. His first is based upon the number of cases reported by Menière and others. I have already shown how inadequate are the proofs from this source. His second is, that irritation rather than mere loss of function in the nerve is proved by the disease being attended with severe vertigo, which may cease when the progress of the disease has produced complete deafness. There is usually so little correspondence between the severity of the vertigo and the amount of the deafness, as Gowers himself remarks elsewhere, that this argument fails. His third is that in the majority of the cases of definite vertigo, the slight or considerable tinnitus that is present is evidence of a process of irritation of the fibres of the nerve. That is true, but the argument is no proof of the source of the irritation being in the semicircular canals or labyrinth. Tinnitus is not an unusual symptom of extra-labyrinthine lesions. His fourth argument is, that slight loss of hearing, tinnitus and vertigo may be observed not only to come on together, but to pass away together. I fail to see that this proves anything more about the labyrinthine origin of the symptoms than does the previous argument. Lastly he asserts that "the frequency with which symptoms of labyrinthine disease are found in cases of vertigo is itself a fact of very great significance. Of 106 consecutive cases in which definite vertigo made the patient seek advice, in no less than 94 ear symptoms were present, tinnitus or deafness, or more often both." The figures are undoubtedly significant in proving the frequent association of vertigo with auditory symptoms, but they are hardly commendable as an argument of the labyrinthine origin of the vertiginous sensation. It seems to me, therefore, that these propositions, which I have presented almost in the author's own words, do not make out a very strong case in favor of the labyrinthine origin of the vertigo; certainly not sufficiently so as to warrant the large percentage of cases of vertigo which this writer attributes to diseases of the internal ear.

It seems to me, furthermore, that he is almost self-contradictory upon this subject. He lays stress in aural vertigo upon the coincidence of the auditory symptoms with the vertigo, and shows that this is due to the continuity of structure in the cochlea and semicircular canals. He says "it is conceivable that labyrinthine vertigo may occur without any auditory symptoms. I have actually seen two or three cases in which definite giddiness existed alone and in which auditory symptoms came on later." Then, when I turn to his account of gastric vertigo, I find this: "I do not think it is quite certain that there is such a thing as definite vertigo of purely gastric origin. . . . We know that in 95 per cent. of the cases of definite giddiness a morbid state of the labyrinth is the real cause of the vertigo." This leads us to infer, then, that in 95 per cent. of the cases of vertigo there are distinct auditory symptoms. Few general practitioners will be prepared to admit so sweeping an assertion. The scarcity of autopsies and the frequency with which Menière's symptoms are found in other nervous affections, such as epilepsy, hysteria, and posterior spinal sclerosis, should render us cautious in attributing the vertigo, loss of hearing, etc., to labyrinthine disease.

After admitting the implication of the semicircular canals in aural vertigo, it is still a difficult matter to explain the vertiginous symptoms and loss of hearing upon this hypothesis in all cases. The one which I have reported might easily have been regarded as a case of Menière's disease, and yet there is no reason to suppose that the vertigo and deafness were due to disease of the semicircular canals. I believe that the function of these canals in the maintenance of equilibrium has been much overestimated, certainly too positively inferred in view of the slight physiological and pathological data which we have as yet for such an inference. Simple puncture of the auditory nerve in rabbits gives rise to rotary movements on the part of the animal, and it is a well-known fact that injection of water into the external ear as well as inflammation of the middle ear causes vertiginous sensations. In these cases there is the sensory disturbance, but can we suppose that in all of them the semicircular canals are so grossly affected as to be the only immediate cause of the vertigo?

Both Steiner and Sewall carefully removed the semicircular canals from the shark, whose auditory apparatus is practically identical with man's, without obtaining any disturbance of movement. After careful investigation, Böttcher and Baginsky have come to the conclusion that the cause of the rotation of the head in Flourens' and Goltz's experiments was injury done to the brain and not merely to the semicircular canals. In the experiments of the former, the head did not always rotate in accordance with the particular canal injured, as Goltz had formulated. The identity of these canals with the cochlea in the embryo, their continuity with the epicerebral space through the aquæductus vestibuli, and their ever-shifting relations among themselves in the quadrumana which go about sometimes in the horizontal, sometimes in the erect position, argue strongly against the special function of these canals being the maintenance of equilibrium. Doubtless there are important sensory impulses of a special character which pass through these organs, but equilibration, due as we have seen to the fusion of a vast complex mass of sensations pouring in upon the brain from all sides, cannot possibly be the result of merely a single set of impulses from such an end-organ as the semicircular canals. The very nature of vertigo involves the idea of more or less loss of consciousness, and this alone would seem to indicate a higher cause for the trouble than simply these canals. Experiment only proves that they are the organs for the perception of direction, but vertigo is something more than the loss of this power alone.

If it be granted that the pathological cause of this vertigo is found in the semicircular canals, it is hard to understand how in all cases the cochlea or the cochlea branch of the auditory nerve should necessarily be affected. In Flourens' experiment, the entire removal of the canals did not impair the hearing. So striking was this that Flourens, as well as others, was led to believe that the branch of the auditory nerve which supplies the semicircular canals subserves motor purposes only. On the other hand, if the results of Gelle's experiments are to be trusted, the cochlea is in no way the source of vertiginous impressions. Simple continuity of structure will not account for the sudden loss of hearing when the lesion is hæmorrhage into the canals, and pressure alone will not answer as a cause in all cases of so called Menière's disease. In the first place, there is no regular correspondence between the amount of deafness and the intensity of the vertigo; secondly, with total loss of hearing in Menière's disease, all known methods of diagnosis prove that the nerve itself, and not merely the internal ear, is affected; thirdly, physiological experiment shows that simple pressure does not cause total loss of hearing when no injury is done to the cochlea or cochlea branch of the auditory nerve; and finally, no case has ever been reported in which the cochlea was primarily affected with consequent involvement of the canals and vertigo, though in blood supply and anatomical structure the cochlea and canals are similar. Hence, in Menière's disease I conclude that the lesion must concern the whole labyrinth or lie entirely outside of it.

It was Dr. Wilks, of England, I think, who held that Menière's disease was a neurosis of the centres of audition and equilibrium, and, in its paroxysmal form at least, was much like migraine with its eye complications. While this explanation cannot be adopted for all cases, there is little doubt about the central nature of the disease in many of its aspects. Burnett declared that "the neuropathic diathesis is well marked in most cases of aural vertigo." The grouping of the symptoms as well as the proximity of the tracts and centres involved, point to the encephalic origin of the affection. Especially is this indicated, however, by the sensori-motor nature of the vertigo whatever be the peripheral source of disturbance, and its association with the state of consciousness.

Running between the superficial and deep roots of the auditory nerve are the external and internal divisions of the inferior peduncle of the cerebellum. According to Spitzka and Edinger, the posterior nerve-root transmits sound impulses, while the anterior root is the path for the impressions which assist in the determination of the equilibrium. Some of the motor fibres of the auditory nerve pass to the ampullæ of the semicircular canals, while others are doubtless associated with the anterior root in particular and the peduncle of the cerebellum. Thus the close connection between the nerve of hearing and the sensori-motor tracts in the medulla, as well as the proximity of the auditory and pneumogastric nuclei, account for the frequent association of the symptoms, deafness, vertigo and vomiting. Any disturbance, then, in the course of the auditory tract, such as in the case I have reported, is liable to give rise to Menière's symptoms. The lesion may assume many forms, but the important point is, that it need not be necessarily limited to the labyrinth. In many of the cases reported, the probability is that it was altogether extra-labyrinthine.

In conclusion, I would say that in Menière's disease the source of irritation may sometimes be in the semicircular canals, just as sometimes it may be in the eye or in the stomach, but that the immediate cause of the vertigo cannot be there, for several reasons:

First: If the above explanation of the nature of vertigo be correct, it is a condition dependent upon the harmonious interaction of the sensori-motor centres of the cortex, and disturbance of these is the real cause of the vertigo.

Secondly: If equilibrium depended solely upon the semicircular canals, there could be no rational explanation for the ocular and stomachal vertigoes.

Thirdly: If the proximity of the various nuclei within the medulla be a sufficient explanation of the association of the symptoms, vomiting, unconsciousness, vertigo and loss of hearing, when the semicircular canals are affected, why, we may justly ask, do we not in stomachal, laethemic and other vertigoes have more marked auditory symptoms?

Fourthly: Experimental injury to the semicircular canals is not followed by true vertigo, loss of hearing and the other constant symptoms of Menière's disease.

Fifthly: Pathological data do not entirely and satisfactorily support Menière's hypothesis. His only case with autopsy can easily be explained upon other grounds, and nearly all of the other cases reported by Politzer, Voltoline and others had severe cerebral lesions, sufficient to account for the symptoms presented.

Finally, it is to be noted that of Bezold's carefully collected 46 cases of necrosis of the labyrinth, only 12 manifested symptoms of vertigo.

Burnett says: "Aural vertigo may be termed a reflex cerebellar phenomenon from irritation in the auditory apparatus." That may be true as far as it goes, but from what I have endeavored to show, aural vertigo may not be aural at all, except in so far as having certain aural symptoms associated with the vertigo; and we are not justified, in view of the few physiological and pathological data still at hand, in assigning all cases of vertigo with loss of hearing to an unknown and undemonstrable lesion of the internal ear.

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